SYNOPSIS

Taxonomy, Biology and Culture Potential of the genus *Caridina* of Achencoil and Pamba Rivers

Research Scholar: G Suvarnakumar Supervisor: Dr M S Sunil
Branch: Zoology University: Mahatma Gandhi University

General Introduction

The species belonging to the genus *Caridina* generally occur in fresh water and are widely distributed throughout the world. Although relatively small in size, these shrimps contribute to a subsistence fishery in certain fresh water and estuarine systems and are quite suitable for culture in the confined waters. They also form an important source of forage of many carnivorous fishes. Most of the investigations carried out on this group of shrimps are in relation to their taxonomy and distribution.

When we use the term “aquaculture” in a more restrictive sense rather than to denote all forms of culture of aquatic animals and plants in fresh, brackish and marine environments we can see prospectiveness in fighting mosquito menace by culturing larvivorous fish such as guppy using *Caridina* larva as chief food. In all fishery aquaculture practices it is a well established fact that live foods can augment fishery output. Likewise the Ornamental fishery prospective is not remote.

Demand for fish is expected to increase to 190 million tons against the present production of about 140 million tons by the year 2010. The increased fishing pressure has led to over-exploitation and stagnation in fish catch from natural resources. Therefore, aquaculture is identified as the only viable

alternative for any further increase in fish production to meet the ever increasing demand by the production fish.

Nature had given everything for man's need but not for his greed. But it is unfortunate to say that his greed (selfishness) is increasing alarmingly day by day. In every food sector of man we can see food adulteration and manipulation. Kerala Government Regional Analytical Laboratory result shows that the vegetables that we import from our neighbouring State Tamil Nadu contains higher levels of pesticide residues very lethal to our health. The situation of fish that we purchase from our market is not remote. The fish vendors use Ammonia and formaldehyde as preservatives rather than using simple ice cubes. All these illegal practices upholds our recent medical reports of increasing incidents of heart and kidney ailments & cancer. In brief, our health is in the stranglehold of these evil practices. So at this juncture, we can see ample possibility for fish aquaculture by using live food especially *Caridina* to cushion the above mentioned evil attempt.

The entire work is described in 8 chapters.

Chapter –I

Survey of the genus *Caridina* from the upstream, middle stream and down stream regions of Achencoil and Pamba rivers.

The survey was carried out from 2009 April to 2010 March in Achencoil & Pamba rivers. This period was divided into four quarters viz, first quarter 2009 April – June, second quarter 2009 July-September, third quarter 2009 October – December and fourth quarter 2010 January – March.

Caridina is available throughout the year. But their number varies with respect to the nature of the habitat and seasons. During summer season (March, April & May) it is practically more easy to collect them. One of the key features

noticed during my sample collection is that they are not available in running water with water currents (water flow). They are seldom present in rocky habitat free from decaying vegetation. This was substantiated by their thin numbers in the upstream regions of both Achenkovil and Pamba rivers. They are abundant in the middle stream and down stream regions of both these rivers except Veeyapuram in Achenkovil and Thakazhi in Pamba were infiltration of salt water occurs from the near by lake. Water is stagnant in these regions which favours thick growth of C*abomba furcata* and Spirogyra like filamentous algae providing ample habitat for *Caridina*. The specimens obtained from these regions differs greatly and need thorough taxonomical examination.

Various meteorological and hydrographical parameters influence their diversity.

Chapter-II

Taxonomy of the genus *Caridina* with regard to meristics and morphometrics.

Meristics pertaining to change in number or in geometric relation to parts of an organism. It differentiate between Genera, species groups, species, sub species, populations or groups within species and individuals. In simple terms meristics is counting method and morphometrics is measuring method.

Identification of *Caridina* collected from Achencoil and Pamba rivers were done. Meristic and morphometric features of *Caridina* were described.
Four species identified have the following taxonomic designation.

Kingdom	:	Animalia
Phylum	:	Arthropoda
Sub Phylum	:	Crustacea

Class	:	Malacostraca
Order	:	Decapoda
Infra order	:	Caridea
Supper family	:	Atyoidea
Family	:	Atyidae
Genus	:	*Caridina*

Key for identification

1. Rostrum long, exceeding beyond the antennular peduncle. 2
   Rostrum moderately long, not exceeding beyond the antennualr peduncle. 5
2. Upper margin of the rostrum with maximum 11 teeth. 3
   Upper margin of the rostrum with more than 11 teeth. 4
3. Distal end of telson end in a median spine; endopod of first pleiopod of male with appendix interna. *C.gracilirostris*
   Distal end of telson does not end in a median spine; endopod of first pleiopod of male without appendix interna. *C.pseudogracilirostris*
4. Rostrum broad, entire upper margin bears teeth, third abdominal segment with a prominent dorsal hump. *C. williamsoni*
   Rostrum slender, upper margin with teeth present only at the proximal part, abdomen with or without a hump. *C. nilotica*
5. Upper margin of the rostrum slightly convex . 6
   Upper margin of rostrum nearly straight, distal end slopping downwards. 7
6. Dorsal surface of telson with four pairs of spines; distal end with 5-7 long plumose setae which are longer than the ones lateral to it.
   C. natarajani

Dorsal surface of telson with 5-6 pairs of spines; distal end with setae of similar size *C.laevis*

7. Distal end of telson with a prominent median spine 8

Distal end of telson without a median spine.

C. *weberi* var. *Sumatrensis*

8. Ischium of fourth and fifth pereiopods with a large spine. *C. Kempi*

Ischium of fourth and fifth pereiopods without any spine. 9

9 Outer antennular flagellum of males with 8-10 and females with 6-7 segments bearing aesthetases. Eggs small .

(0.33-0.44 x 0.57 – 0.68 mm) *C. Shenoyi*

Outer antennular flagellum of males with 14-17 and females with 7-11 segments bearing aesthetases. Eggs large .

(0.50-0.65 x 0.75-0.90 mm) *C. gurneyi*

Chapter-III

Study of food and feeding

Caridina eats several food items which includes Onion, Bengal gram flour, Green gram, earthworms (pieces), cooked duck egg white and hen's egg yellow yolk, foliages of *Limnophila indica*, *Cabomba furcata, Utricularia gibba,* Filamentous algae ,algal encrustation on the side of the aquarium, green water (Chlorella species) and an array of several food items.

Manner of feeding

Chapter-IV

Study of moulting process– Both in males and females by considering temperature as a parameter.

In general, larvae hatch out in relatively advanced stage and pass through 4 to 5 moults during a period of 11 to 12 days under laboratory conditions of temperature at 28^{o}C and salinity 16-17 ppm.

Role of temperature in the moulting of male and female were studied

Chapter-V

Study of Breeding.

As *Caridina* breeds throughout the year, it is easy to maintain them in any aquaculture systems. They are easily available throughout the year. They are convenient in size to handle and maintain them the laboratory. Their early maturation, good fecundity are good factors for breeding purpose. Apart from this, their egg size, success of rearing of larvae in fresh to Saline waters using a simple technique with almost 100% survival rate etc are good factors to be considered for their breeding was studied.

Importance of certain floating and submerged aquatic plants with regard to breeding.

Chapter-VI

Biochemical parameters favouring the recent appearance of *Cabomba furcata* in the river Achencoil and its impact on the habitat of *Caridina.*

Illegal sand mining is a blessing for some kinds of flora and fauna in several rivers of Kerala owing to the changes in the habitat. The habitat change coupled with the increase in Iron content in the soil sediment is a great solace for *Cabomba furcata.* The dissected leaves of *Cabomba furcata* is a comfortable habitat for the young ones (2 mm size) as well as the adults. *Caridina* and *Cabomba furcata* are antagonistically related with regard to oxygen and carbon dioxide requirements. *Caridina* requires less oxygen and *Cabomba furcata* requires large levels of carbon dioxide for their growth.

Cabomba furcata is a very recently appeared Angiosperm in the river Achencovil. Several decades ago the river bed of Achencovil was richly sandy bedded with pebbles. But in the last one decade, changes had occurred profoundly in the habitat of several rivers in Kerala, especially of Achencovil. Now the river is in the form of a small lake without any water currents.. This favoured the deposition of many organic and inorganic substrates particularly of Iron which can act as an inevitable component for the rich growth of *Cabomba furcata*. It is an Angiosperm that grows in dense mats in shallow quiet waters rich in organic substrates especially Iron. It grows to a maximum height of 80cms and requires very bright light.

Its foliage is good for the *Caridina* to lay their eggs, incubating and hatching the young ones. Adult will also feed on the foliages. The larvae can hide comfortably among the leaves so that they can evade the attention of prey fishes and other animals. *Caridina* is a small (1.5-3 cm long) Omnivorous shrimp which can live even in polluted waters with low O_2 level. There are several species of *Caridina* which can live comfortably among the foliages of *Cabomba furcata*. We can also culture *Caridina* in indoor aquariums with *Cabomba furcata* as aquatic plant. So cultured *Caridina* can be used as food for many ornamental fishes such as Tiger barb, Oscar fish and Guppy. As Guppy is a larvivorous fish, it can be cultured by using *Caridina* larvae as food. This can be used as a way for fighting against mosquito menace to some extent.

Oxygen requirements of *Cabomba furcata* and relationship of iron content and growth of *Cabomba furcata* were studied. Also the antagonistic relationship of *Caridina* & *Cabomba furcata* were noted.

Chapter –VII

Aquaculture of *Caridina natarajani* - An insight into the potential as live food for aquaculture animals.

Feed is one of the major inputs and forms the single major item in the running expenditure of any aquaculture systems. The development of cheap and efficient feed is therefore of prime importance in any culture operation.

Like any other animals, fish also require nutrients to stay alive, healthy to resist diseases, active and to grow. Nutrients play numerous roles. They are the building blocks of all tissues of the animals and they are involved in all the chemical reactions that make up the life. Types of nutrients required by fish are the same as those required by other animals and humans too. Nutrients can be provided by various products of plant origin, animal origin and microbial origin or can be chemically synthesized. In nature, fish obtain nutrient from various types of food items, these being determined both by the feeding behaviour or preference of the fish and the availability of food items.

The efficacy of *Caridina* as live food for several aquacultural animals was an established fact beyond doubt (Jayachandran, Tessi and Raji, 2004). Larval and adult stages of many aquaculture species grow well on live animal foods. Several carnivorous ornamental fishes such as Oscar fish, Angel fish, Arowana, Gold fish, Pirana and Tiger barb eat *Caridina* very actively. Guppy feed actively on its larvae. So an ornamental fish aquaculturist can easily maintain a reservoir aquarium with *Caridina* along with his entire aquaculture setup. This is a cheapest method of providing live food because it did not require any aeration facility. The fry and larvae of many culture fishes such as *Catla Catla*, Grass carp, Tilapia etc will eat the *Caridina* larvae voraciously

(Hora and Pillay, 1962). So it is also possible to maintain the above mentioned reservoir aquarium along with such fish culture endeavours. An aquaculturist who judiciously use *Caridina* culture will be get more benefitted.

Maintenance of observation aquarium and reservoir aquarium. Potential of *Caridina* as live food for some Ornamental fishes and Culture fishes.

Chapter-VIII

Aquaculture potential of larvivorous fish Guppy using *Caridina* larva and mosquito larva as food.

Though Guppy is an ornamental fish, it can be used as a biological tool for controlling mosquito menace. In Indoor Aquarium they can be cultured in large numbers by using *Caridina* larvae as food. By using the aquatic plant *Utricularia gibba, Caridina* can be cultured in mass quantity in indoor aquariums. The highly entangled and intertwining mesh of the stem of *Utricularia gibba* in large numbers provides a very good habitat for laying, incubating and hatching *Caridina* eggs.

If we do it judiciously it is a giant leap towards mitigating mosquito menace.